

DIRECTED WORD CHAIN NETWORKS (PART 3)

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This is the third of a series of articles on directed word chain networks; the first two can be found in the August 1991 **Word Ways**. Specifically focussing on (8,4) word chains, it is divided into two sections. The first introduces a two-dimensional construction called a mesh; the second updates and extends Part 2, using an enlarged word list. All terms are defined in Part 1.

As described in Part 2, the original list of 2813 words containing 960 different frags was taken from a computerized Official Scrabble Players Dictionary database, augmented by a hand search of Webster's Second and Third and Chambers Twentieth Century Dictionary for eight-letter words suitable for long chains. Since the earlier article, further searches of Webster's Second (plus an exchange of lists with Christopher McManus) has resulted in a list of 6191 words (a 120% increase) with 1394 different frags (a 45% increase). Note how few new core frags accompany the large increase in words; the original search fairly well established the core. The frag types are tabulated below ("other" frags consist of preceders and followers, both defined in Part 1):

	frags	core	beginner	ender	other
Part 2	960	507	119	142	192
Part 3	1394	659	205	181	349

Meshes

A mesh is a rectangular array of frags from word chains arrayed in rows and columns and interlocking in the manner of a word square. Below are samples of the largest meshes I could find using a microcomputer. Read the frags pairwise from left to right and from up to down; all eight-letter combinations are solid words. These large meshes have a more or less common theme, so only a few are shown. I was not quite able to complete any 6x6 meshes; both 4x9 and 6x6 meshes use 36 frags, but more intersection is required in the latter. Quite a few 5x7 meshes are possible.

fore-body-surf-fish-hold-over-long-hair-bird	lower left corner
play-work-boat-tail-back-fire-wood-worm-seed	alternates: side-lock,
down-hand-bill-head-wind-ball-cock-weed-like	side-line, pipe-line,
town-wear-able-gate-ward-room-mate-less-ness	land-lock, land-line

fore-hand-line-side-long-wool-ball	
hold-fast-back-bone-wood-rock-weed	lower left corner
over-land-wash-tail-wind-fish-hook	alternate: cook-book
fire-lock-work-head-ship-worm-like	shop-lift
plug-hole-able-gate-ward-less-ness	

over-fire-back-hand-play-room
 long-tail-wind-blow-down-some
 hair-band-fish-line-side-wise
 slip-case-wood-work-head-like
 horn-book-land-ship-ward-walk
 bill-able-gate-ways outs

fire-plow-foot-walk-outs-cent
 wood-fish-hold-over-well-ring
 land-line-back-work-head-lock
 rail-side-wash-hand-load-able
 road-show-down-play-some-gate
 book-case-weed-like-ways

tide-flat-foot-note-case-mate
 mark-land-rail-head-work-ship
 down-line-side-long-hand-load
 turn-back-bone-tail-like-some
 over-fire-wood-ward-walk-ways
 wind-fall-fish-able ides

fore-play-folk-rock-rose-leaf
 take-down-land-fall-fish-worm
 over-hand-line-back-bone-wood
 slip-rail-side-band-work-shop
 knot-head-note-case-book-lift
 horn-like-wise-weed-less

More than half a million 5x5 meshes can be constructed out of my 6191-word database; a tiny fraction of these are listed in the appendix. All of them shown have variations. Most meshes of any size begin with *fore* or *over* and end with *like* or *less* converging to *ness*; however, the appendix samples show a variety of beginning (upper left) and ending (lower right) frags. The 5x5 format is well-suited for showing such variety.

Updates

The one-way span of the (8,4) directed word chain network has been reduced from 17 to 16, but otherwise has the same character. As in the earlier article, the central portion of the core contains common four-letter word frags, but many of the frags at the beginning or end are non-words (or, possibly, obsolete spellings in the OED). The portion of the core following the span is an example of a beginning sequence using mostly non-word frags.

cope-rose-bush-buck		cart-whip-cord-wain-scot
		back-hand
	hold	
abam-pere-grin-ding-maul-anas-arca-dias	outs-port	
copy		
	line	ance-rata-plan-gent-rice
	side-show	
pine-land		
lipo-cere-bron	lage-ring-	
	chia-smal	
camo-deme-anor	tite-vate-rite-less	

Although it is possible to create very long (8,4) chains, it is more challenging to find chains of a specific length between stated ends. With a computer, I have gone one step further. In the following **word to ways** chains, **wordster**, **wordplay** and **wordbook** are used as often as needed, but otherwise no frag is repeated in this set. The series is not optimized; a longer set is possible. Recognizing **shipable**, **rockling**, **overshoe**, and **roadster**, note how easy it is to combine portions of these chains into one long one. Furthermore, new sections like **hand-clap-trap-door-post-lude-rick-yard-land**, etc., can be inserted here and there.

WORD-play-land-iron-shod-dies-trus-sing-song-book-rock-WAYS

WORD-book-able-gate-ward-maid-hood-mold-warp-wise-weed-like-WAYS

WORD-play-list-work-week-long-hair-lock-wire-draw-stop-bank-roll-WAYS

WORD-book-mark-shot-guns-lick-some-deal-bate-ment-hone-wort-hier-arch-WAYS

WORD-play-shoe-make-fast-back-wash-dish-pans-hard-boot-jack-stay-sail-ship-WAYS

WORD-book-rest-rain-coat-tail-spin-outs-corn-meal-tide-flat-beds-taff-rail-road-WAYS

WORD-play-down-bear-cats-tick-bean-pole-burn-fire-base-lard-worm-wood-cock-bell-wind-WAYS

WORD-ster-nine-fold-boat-load-star-ches-nuts-edge-bone-shaw-fowl-foot-folk-free-hand-cart-WAYS

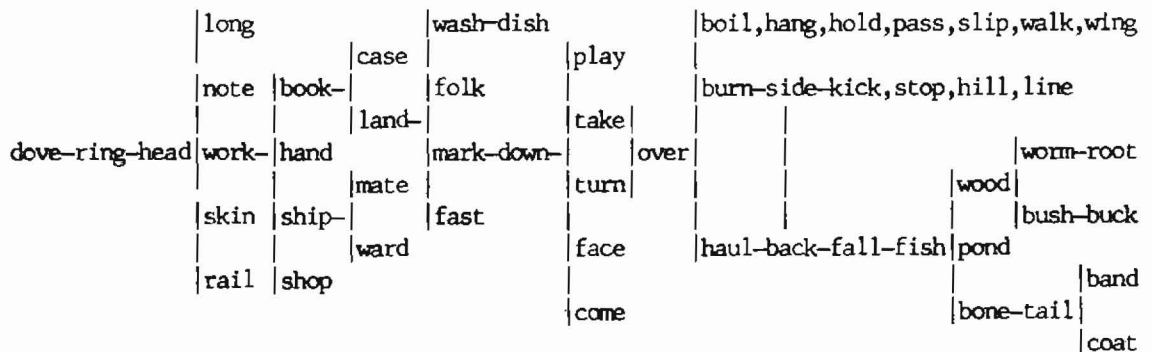
WORD-book-fair-lead-offs-cape-line-side-bars-poon-tang-ency-clic-king-pins-pots-hots-purs-lane-WAYS

WORD-play-bill-fish-bolt-head-band-hook-nose-wing-bows-prit-chel-inga-ther-mite-ring-walk-over-high-WAYS

WORD-ster-ling-bird-call-over-ance-rata-plan-form-ally-late-bras-sage-rose-bush-buck-jump-seed-ball-park-WAYS

Here are explanations of a few of my favorite eight-letter words: a foreiron (Web 3) is not a golf club but part of a plow; a cockhead is not an upside-down cocktail but the stem of a grinding wheel; bearfoot (Web 2) is an herb; tailhead (Web 3) is the base of an animal's tail; burnover (Web 3) is an imperfectly-burned brick; hightide (Web 2) is a festival; a bookmate (Web 2) is a schoolmate; downgone (Web 2) means downcast or unhappy; gonesome (Web 2) means having a gone feeling; a workboat (Web 2) is indeed a boat; workshop (Web 2) is a variation of workmanship; a landship (Web 3) is a large covered wagon; bookland (Web 3) is not a place to read books but the opposite of folkland (Web 3), a legal term regarding landholding; likewalk (Chambers) is an alternate of lykewake or latewake (Web 3), simply a wake; coneplate or coneplate (Web 3) is a Mexican name for an animal commonly known as a hog-nosed skunk.

Part 2 gave a list of reversible words (such as bookcase and casebook). This list, given in the appendix, is now 150 words long with 91 different frags represented. All 91 frags are core frags and common four-letter words. 56 of these constitute a core with bidirectional links as in the standard Carrollian word network. This core is shown below; it has a span of 16.



Other aspects of (8,4) chains are incorporated in the following two puzzles:

PUZZLE 1: Using only the 28 four-letter frags listed below, how

many 4x4 meshes can you construct? All eight-letter combinations must be listed as solid words in either Web 2, Web 3, OSPD or Chambers. A frag may not be used more than once in a mesh.

back ball band bell bone door dove fast fire fish hand head hold lady
land like long ring ship side skin star tail wash weed wind wood worm

PUZZLE 2: Fill a blank with an eight-letter word so as to make two more eight-letter words. There might be more than one way to fill each blank. The frags of a fill-in word need not be words.

A. boat _____ ship B. back _____ side C. head _____ tail
sample: tailwind stopover longhorn
D. bookmark _____ dingbats E. pinafore _____ dateable

APPENDIX

backfall backfire backhaul backkick backstop bandtail barabara birdcage
birdseed birdsong boilover bonefish bonetail bookcase bookland bookwork
bootjack buckbush burnover burnside bushbuck bushwood cagebird caracara
casebook chowchow coattail comedown couscous deerkill dishwash dividivi
dovering downcome downface downplay downtake downturn downwash facedown
fallback fallfish fastland fireback fishbone fishfall fishpond fishwood
folkland ganggang gangplow greegree handwork hangover hardpans haulback
haulover headlong headnote headrail headring headskin headwork hillside
holdover hometown hookweed hotshots jackboot kavakava kickback killdeer
kouskous landbook landfast landfolk landmark landwash lavalava likewise
lineside lockpick longhead markland matamata mateship notehead overboil
overburn overhang overhaul overhold overpass overslip overtake overturn
overwalk overwing panshard passover picklock piri-piri playdown plowgang
pondfish railhead ringdove ringhead rootworm seedbird shipmate shipward
shipwork shopwork shotstar sideburn sidehill sideline skinhead slipover
songbird starshot stopback tailband tailbone tailcoat takedown takeover
ticktick townhome turndown turnover walkover wardship washdish washdown
washland weedhook wingover wiselike woodbush woodfish woodworm workbook
workhand workhead workshop workshop wormroot wormwood

dead-line-back-down-hand
wood-side-wash-land-rail
fish-bone-tail-wind-road
bolt-work-head-ring-ster
hole-able-gate-like-ning

anti-king-head-wind-root
pole-wood-land-ship-word
star-fish-line-side-walk
ring-tail-back-wash-outs
neck-band-work-hand-wear

anti-body-surf-boat-bill
pole-wood-fish-tail-head
burn-side-line-back-land
over-lock-work-hand-rail
door-step-wise-ling-bird

arch-fire-back-stop-over
king-side-band-work-hand
fish-bone-tail-head-rail
pole-wood-wind-ring-like
star-worm-root-wise-lier

deck-hand-hold-over-hard
head-line-back-fire-tail
rail-side-bone-wood-wind
road-show-yard-land-ward
book-shop-work-folk-mote

high-bush-fire-pink-root
tide-land-fall-fish-worm
head-line-back-bone-wood
ring-side-wash-tail-wind
lock-step-down-ward-ship

drop-kick-down-time-keep
line-back-wash-work-able
side-bone-tail-head-gate
rose-wood-wind-ring-like
leaf-worm-root-wise-ness

free-hand-line-side-rose
hold-fast-back-bone-wood
over-land-wash-tail-wind
word-book-work-head-ring
play-mate-ship-ward-walk

hair-line-side-show-down
slip-back-bone-yard-land
over-fire-wood-work-book
hard-ball-cock-head-rest
ware-room-mate-ship-ward

even-down-turn-tail-race
hand-hold-over-head-line
bill-back-land-rail-side
fish-wood-wind-road-show
wife-ward-ship-work-boat

burn-over-crop-land-sick
side-long-head-ward-room
wash-hand-work-ship-mate
down-play-book-worm-less
gone-some-wise-like-ness

deer-hair-line-side-ward
horn-tail-back-wash-room
fish-bone-wood-work-some
bolt-head-note-book-wise
rope-band-case-worm-weed

home-body-surf-fish-wife
life-work-boat-tail-ward
long-hand-bill-head-ship
hair-line-back-band-worm
wood-side-spin-ster-ling

bear-foot-back-band-case
wood-work-hand-fish-worm
cock-boat-bill-hook-weed
bell-tail-head-land-like
wind-ward-ship-side-walk

blue-wing-over-land-lock
wood-fish-line-side-step
cock-tail-back-wash-down
head-band-work-hand-play
note-case-book-rest-ward

shee-fish-hold-over-word
ring-tail-back-hand-play
side-bone-wood-work-some
long-head-land-book-wise
hair-lock-wire-worm-weed

shee-fish-hold-over-hand
ring-tail-back-door-bell
side-band-work-head-wind
show-case-book-land-ward
lace-wood-shop-mark-mote

hand-blow-down-play-date
hold-back-wash-work-book
over-fire-tail-head-land
long-wood-wind-ring-lock
root-ward-ship-side-step

wild-fire-plow-foot-note
wood-fall-back-band-case
rock-fish-bone-work-book
hair-tail-head-ship-worm
bell-wind-ring-side-ling

down-fall-fish-pole-star
line-back-bone-wood-worm
side-band-tail-wind-ling
wash-work-head-ring-bird
hand-bank-note-wise-weed

over-king-fish-pole-star
fire-side-bone-wood-worm
back-wash-tail-wind-ling
wash-work-head-ring-bird
hand-bank-note-wise-weed

blow-fish-hold-over-word
pipe-line-back-work-book
wood-side-bone-head-rest
land-wash-tail-wind-ring
look-down-ward-ship-lets

bell-tail-bone-head-post
wind-pipe-wood-land-mark
fish-line-side-wash-down
hold-back-band-work-hand
over-door-case-book-rest

tide-flat-long-hair-meal
land-iron-head-band-worm
slip-back-wind-fish-wood
over-hand-blow-line-side
pass-book-case-work-wise

chee-king-fish-worm-root
ring-side-bone-wood-ward
head-long-tail-wind-ship
land-line-back-fall-ways
wire-work-hand-outs-ides

anti-slip-over-fall-fish
type-form-feed-back-wood
face-work-head-land-wind
down-hand-rail-side-burn
pipe-line-like-walk-able

draw-stop-over-wind-sail
tube-work-hand-blow-fish
rose-head-line-back-bone
bush-land-side-wash-tail
fire-lock-step-down-pipe

farm-hand-play-down-turn
land-line-back-bear-skin
iron-side-bone-wood-worm
head-long-tail-wind-root
ring-neck-band-fish-hold

hair-line-side-wash-down
slip-back-band-work-hand
over-fire-tail-head-rail
long-wood-wind-ring-bird
wool-rock-fish-worm-seed

blow-down-hold-over-play
fish-line-back-work-book
wood-side-bone-head-rest
land-wash-tail-wind-ring
lock-able-gate-ward-ites

bush-land-iron-side-show
wood-fall-back-wash-down
wind-fish-bone-tail-pipe
ring-bolt-work-head-line
lock-hole-able-gate-ages

cape-line-back-down-hold
ring-side-wash-hand-fast
bone-head-work-book-land
wood-wind-ship-worm-like
grub-root-ward-less-ness

sand-blow-iron-head-work
fish-line-side-long-some
hold-back-bone-tail-gate
over-fire-wood-wind-ward
live-trap-rock-fall-ages